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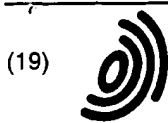
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### (54) Extendable seat

(57) An extendable seat for a chair is disclosed. The chair includes a seat cushion (1) having a first portion (2) proximate to the back of the chair, and a second portion (3) positioned forward of the first portion. The first portion (2) is fixed in the longitudinal plane in relation to the chair back. The second portion (3) has an extending section (4) and a forward section (6). The extending section (4) includes a plurality of transverse slits (5) extending therethrough. The slits are arranged in a plurality of transversely running rows, wherein the extending section lengthens longitudinally upon opening of the slits, and the forward section is moved by the extending section. The extendable seat also includes a support as-

sembly having a first seat pan (10) connected to the first portion (2), a second seat pan (13) connected to the second portion (3), and an actuating structure. The second seat pan (13) is slidably connected to the first seat pan (10). The actuating structure includes a lever having a first end (20), a vertex (22), and a second end (23). The first end (20) of the lever is pivotably connected to the first seat pan (10), the vertex (22) is connected to the second seat pan (13), and the second end (23) is threadably connected to an actuating member (30). The actuating member (30) is adapted to move the second seat pan (13) relative to the first seat pan (10) upon rotational movement of the actuating member (30) about its longitudinal axis.

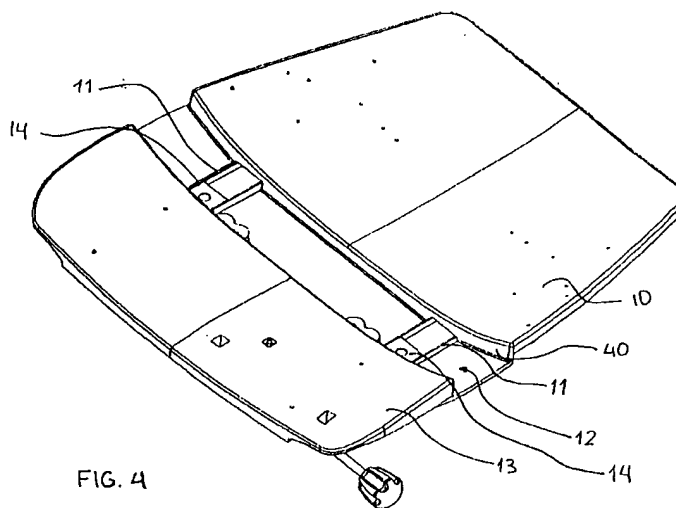


FIG. 4

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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

[0001] This invention relates to a seat, and in particular, to an extendable seat for a chair.

#### Description of the Prior Art

[0002] Chairs with adjustable seat portions are well known, especially in the field of office furniture. An office environment, in which the user sits in the same position for many hours, requires a chair which is comfortable and encourages a healthy posture. Chairs which do not encourage healthy posture may lead to various health problems for the user, such as back or neck pain. Accordingly, office chairs are often provided with seats which are adjustable and correspond to the position of the user's buttocks and thighs. One of the ways the chairs may be adjusted, is by horizontally translating the seat closer to or further from the back support in a generally perpendicular direction therefrom, in order to provide optimal support for the upper legs (up to the knee) of the user.

[0003] However, adjusting a seat in this manner may affect the posture of the user by forcing his/her buttocks further away from the back of the chair. Accordingly, seats have been developed which extend or lengthen in order to accommodate varying leg lengths.

[0004] One such extending seat is disclosed in US Patent No. 5,370,444. This patent discloses a seat which includes a number of transverse openings which widen to permit the seat to extend. However, the openings do not penetrate the entire height of the seat cushion. A section of cushion material remains to cover the top of the openings. This configuration is disadvantageous because sufficient material must remain to allow it to extend as the seat widens. Accordingly, in the unextended position, the covering material must be folded into the opening in an unsightly manner which may also cause discomfort to the user.

[0005] Another extending seat is disclosed in US Patent No. 4,773,703. This patent discloses a seat which is composed of several discrete and unconnected seat elements which move away and toward each other, rather than a single extendable seat cushion. As the seat extends, the gaps between the elements may become sufficiently large to cause discomfort to the user.

[0006] Accordingly, there is a need for a chair with an extendable seat having a simpler and more comfortable configuration.

### SUMMARY OF THE INVENTION

[0007] Accordingly, it is an object of the invention to provide a simpler and more comfortable extendable

seat which does not change shape or position beneath the buttocks of a user, but which can be lengthened or shortened to provide support for the upper legs up to the back of the knees.

5 [0008] An extendable seat is provided. The extendable seat for comprises a seat cushion having an extending section. The extendable seat preferably also includes a first portion proximate to the back of the chair, and a second portion positioned forward of the first portion. Preferably, the first portion is fixed in the longitudinal plane in relation to the chair back, and the second portion includes the extending section as well as a forward section. The extending section defines a plurality of transverse slits extending therethrough, the seat cushion being adapted to extend longitudinally upon opening of the slits. The slits are preferably arranged in a plurality of transversely running rows, wherein the extending section is adapted to lengthen longitudinally upon opening of the slits, and the forward section being adapted for movement by the extending section. The extendable seat preferably includes a support assembly having:

- (i) a first seat pan connected to the first portion;
- (ii) a second seat pan connected to the second portion, the second seat pan being slidably connected to the first seat pan; and
- (iii) an actuating structure having a lever and an actuating member connected to the lever, the lever having a first end, a vertex, and a second end, the first end of the lever being pivotably connected to the first seat pan, the vertex being connected to the second seat pan, and the second end being threadably connected to the actuating member, the actuating member being prevented from translational movement, the lever being adapted to move the second seat pan relative to the first seat pan upon rotational movement of the actuating member about its longitudinal axis.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In order that the invention may be more clearly understood, the preferred embodiment thereof will now be described in detail by way of example, with reference to the accompanying drawings, in which:

- Fig. 1 is a perspective view of an extendable seat cushion according to a preferred embodiment of the present invention;
- Fig. 2 is a perspective view of the seat cushion in the extended position;
- Fig. 3 is a top perspective view of a support assembly according to a preferred embodiment of the present invention;
- Fig. 4 is a top perspective view of the support assembly in the extended position;
- Fig. 5 is a bottom perspective view of the support

assembly in the extended position;

Fig. 6 is a bottom perspective view of the support assembly in the home or closed position;

Fig. 7 is a top perspective view of the first seat pan showing the actuating assembly in the home position; and

Fig. 8 is a top perspective view of the first seat pan showing the actuating assembly in the extended position.

#### **DESCRIPTION OF THE PREFERRED EMBODIMENT**

**[0010]** Figs. 1 and 2 show the extendable seat cushion 1, which is made from any suitable resilient and expandable material, such as an expandable foam. Preferably, the foam is a conventional two-component urethane foam, such as a non-CFC producing flexible polyurethane, based on a polyol blend and diphenylmethane. This foam is commonly referred to as MDI foam.

**[0011]** As shown in Figs. 1 and 2, the cushion 1 includes, at least a first portion 2 adjacent to the back of the chair (not shown), which is preferably fixed in the horizontal direction. The cushion also includes an extendable and preferably integral second portion 3 located forward of the first portion. The first portion is preferably formed to conform to the shape of a users buttocks and upper legs in order to promote proper posture.

**[0012]** Referring again to Figs. 1 and 2, the second portion includes an extending section 4 where a plurality of transverse slits 5 are cut through the entire thickness of the cushion. This design permits the manufacture of a cushion to having a unitary construction, and eliminates the unsightly and uncomfortable bunching or folding of cushion material in the home (or unextended) position of the prior art cushions. The slits are preferably formed by a conventional cutting die and are preferably arranged in rows. The actual number of rows of slits can vary depending on the size of the seat, but is preferably an even number. The location, shape, and orientation of the slits 5 preferably allows the foam to be extended only within the extending section 4 of the second portion 3 (as best shown in Fig. 2). Preferably, an integral front section 6, which is moved by the extending section, but which does not include the slits, is positioned forward of the first section. The cushion is secured to a support assembly (shown in Figs. 3-8) described in detail below.

**[0013]** The cushion 1 may be supported by any suitable support assembly. Figures 3-8 show a preferred support assembly. In the interest of clarity, the cushion is not shown in Figs. 3-8. A first seat pan 10 is secured to the first portion 2 of the cushion 1 (shown in Figs. 1 and 2) by any conventional means, such as an adhesive or screws. The first seat pan is preferably fixed in the horizontal direction. Two longitudinally running roller bearing rails 11 are secured to a recessed front portion 12 of the first seat pan by screws. A depression 41 in the recessed front portion houses an actuating structure described in detail below. A second seat pan 13 is secured

to the front section 6 of the second portion 3 (shown in Figs. 1 and 2) of the cushion by any conventional means, such as an adhesive or screws. The second seat pan is slidably received within the recessed front portion of the first seat pan. Two longitudinally running sliding members 14 are received within the rails, and are secured to the underside of the second seat pan by screws. The seat pans can be made from any suitable material such as, for example, a hard plastic, wood, or steel.

**[0014]** The cushion 1 may be extended by any suitable actuating structure. Figures 5-8 show a preferred actuating structure. As best shown in Figs. 7 and 8, a first end 20 of an L-shaped lever 21 is pivotally connected to the first seat pan 10 by any suitable means, such as a pin. A vertex 22 of the lever is secured to the second seat pan 13 (not shown in Figs. 7 and 8 for clarity) preferably by a bolt 34. A second end 23 of the lever is pinned to a slide block 24 by a slide pivot pin 25. A channel 26 is defined in the slide block, in which a threaded slide nut 27 (shown in Fig. 5) is secured. A correspondingly threaded rod 28 is received within the nut and is positioned in the channel. The threaded rod projects transversely from the side of the second seat pan 13 through an opening 29 (shown in Fig. 5). An adjustment knob 30 is secured to the projecting end of the threaded rod by a knob locking pin (not shown). A lock washer 32 (shown in Fig. 5) is secured within a groove 33 defined in the threaded rod. The lock washer abuts against the edge of the opening 29 in the side of the second seat pan 13.

**[0015]** Figures 1, 3, 6, and 7 show the seat in the unextended or home position. The second seat pan 13 is fully received within the recessed portion 12 of the first seat pan 10 such that the second seat pan abuts and is flush with a ridge 40. A user can extend the seat by rotating the adjustment knob 30 on the threaded rod 28. The threaded rod is prevented from transverse movement relative to the second seat pan 13 by the lock washer 32 which abuts against the side of the second seat pan. The rotation of the threaded rod within the threaded slide nut 27 causes the slide block 24 to travel transversely along the threaded rod away from the side of the second seat pan 13. The movement of the slide block causes the lever 21 to pivot, which in turn causes the bolt 34 in the vertex 22 of the lever 21 to move forward. The bolt moves the second seat pan 13 forward causing sliding members 14 to slide away from the front seat pan 10 along the rails 11. The moving second seat pan pulls the forward section 6 of the second portion 3 of the cushion 1 forward, causing the slits 5 in the extending section 4 to open, and the seat to extend.

**[0016]** Figures 2, 4, 5 and 8 show the seat in the extended position. The seat can be returned to the unextended position by rotating the adjustment knob 30 in the opposite direction, which reverses the process described above.

**[0017]** It will be appreciated that the above description

relates to the preferred embodiment by way of example only. Many variations on the invention will be obvious to those knowledgeable in the field, and such obvious variations are within the scope of the invention, whether or not expressly described.

#### Claims

1. An extendable seat for a chair comprising a seat cushion having an extending section, the extending section defining a plurality of transverse slits extending therethrough, the seat cushion being adapted to extend longitudinally upon opening of the slits.
2. The extendable seat of claim 1 further comprising a first portion proximate to the back of the chair, and a second portion positioned forward of the first portion, the second portion including the extending section and a forward section, wherein the extending section is adapted to lengthen longitudinally upon opening of the slits, the forward section being adapted for movement by the extending section.
3. The extendable seat of claim 2, wherein the first portion is fixed in the longitudinal plane in relation to the chair back.
4. The extendable seat of claim 3, wherein the slits are arranged in a plurality of transversely running rows.
5. The extendable seat of claim 4, further comprising a support assembly for the seat cushion.
6. The extendable seat of claim 5, wherein the support assembly comprises:
  - (a) a first seat pan connected to the first portion;
  - (b) a second seat pan connected to the second portion, the second seat pan being slidably connected to the first seat pan;
  - (c) an actuating structure for adjusting the position of the second seat pan relative to the first seat pan.
7. The extendable seat of claim 6, wherein the first seat pan is connected to a bottom surface of the first portion of the seat cushion, and the second seat pan is connected to a bottom surface of the forward section of the second portion, wherein in the home position, the second seat pan is received within a recessed portion of the first seat pan, and in the extended position the second seat pan slides forward out of the recessed portion.
8. The extendable seat of claim 7, wherein the support assembly further comprises at least one longitudinally running rail disposed within the recessed portion, the rail being adapted to slidably engage a corresponding longitudinally running member connected to an underside of the second seat pan.
9. The extendable seat of claim 8, wherein the support assembly comprises two substantially parallel spaced apart longitudinally running rails engaging two corresponding longitudinally running members.
10. The extendable seat of claim 7, wherein the actuating structure comprises:
  - (a) a lever pivotably connected to the first seat pan, the lever being connected to the second seat pan, the lever being adapted to move the second seat pan relative to the first seat pan; and
  - (b) an actuating member connected to the lever, the actuating member being adapted to move the lever.
11. The extendable seat of claim 10, wherein the lever has a first end, a vertex and a second end, the first end being pivotably connected to the first seat pan, the vertex being connected to the second seat pan, and the second end being connected to the actuating member.
12. The extendable seat of claim 11, wherein the lever is L-shaped.
13. The extendable seat of claim 12, wherein the actuating member is threadably connected to the second end of the lever.
14. The extendable seat of claim 13, wherein the actuating member is prevented from translational movement, the actuating member being adapted to move the lever upon rotation of the actuating member about its longitudinal axis.
15. The extendable seat of claim 5, wherein the first portion and second portion are integral.
16. The extendable seat of claim 15, wherein the extending section and forward section are integral.
17. The extendable seat of claim 16, wherein the seat cushion is made from a resilient material.
18. The extendable seat of claim 17, wherein the seat cushion is made from an MDI foam.
19. An extendable seat for a chair comprising:
  - (a) a seat cushion having an extending section, the extending section defining a plurality of transverse slits extending therethrough, the

seat cushion being adapted to extend longitudinally upon opening of the slits; and  
 (b) a support assembly connected to a bottom surface of the cushion, the support assembly having an actuating structure connected thereto.

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**20.** An extendable seat for a chair comprising:

(a) a seat cushion having a first portion proximate to the back of the chair, and a second portion positioned forward of the first portion, the first portion being fixed in the longitudinal plane in relation to the chair back, the second portion having an extending section and a forward section, the extending section defining a plurality of transverse slits extending therethrough, the slits being arranged in a plurality of transversely running rows, wherein the extending section is adapted to lengthen longitudinally upon opening of the slits, the forward section being adapted for movement by the extending section;

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(b) a support assembly having:

(i) a first seat pan connected to the first portion;

(ii) a second seat pan connected to the second portion, the second seat pan being slidably connected to the first seat pan; and

(iii) an actuating structure having a lever and an actuating member connected to the lever, the lever having a first end, a vertex, and a second end, the first end of the lever being pivotably connected to the first seat pan, the vertex being connected to the second seat pan, and the second end being threadably connected to the actuating member, the actuating member being prevented from translational movement, the lever being adapted to move the second seat pan relative to the first seat pan upon rotational movement of the actuating member about its longitudinal axis.

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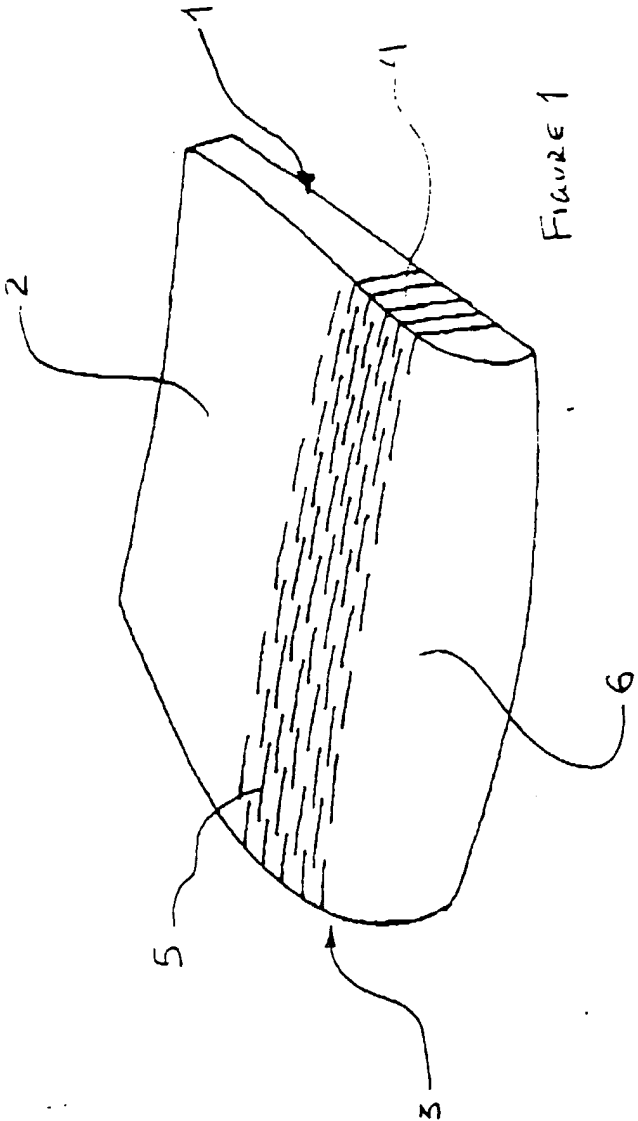


Figure 1

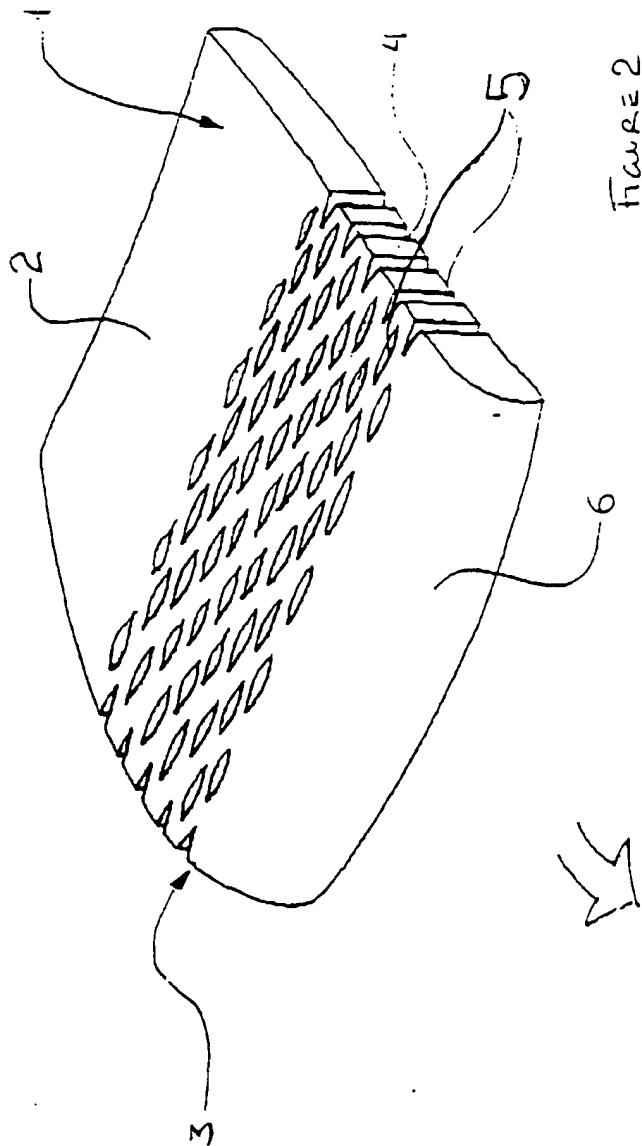


FIGURE 2



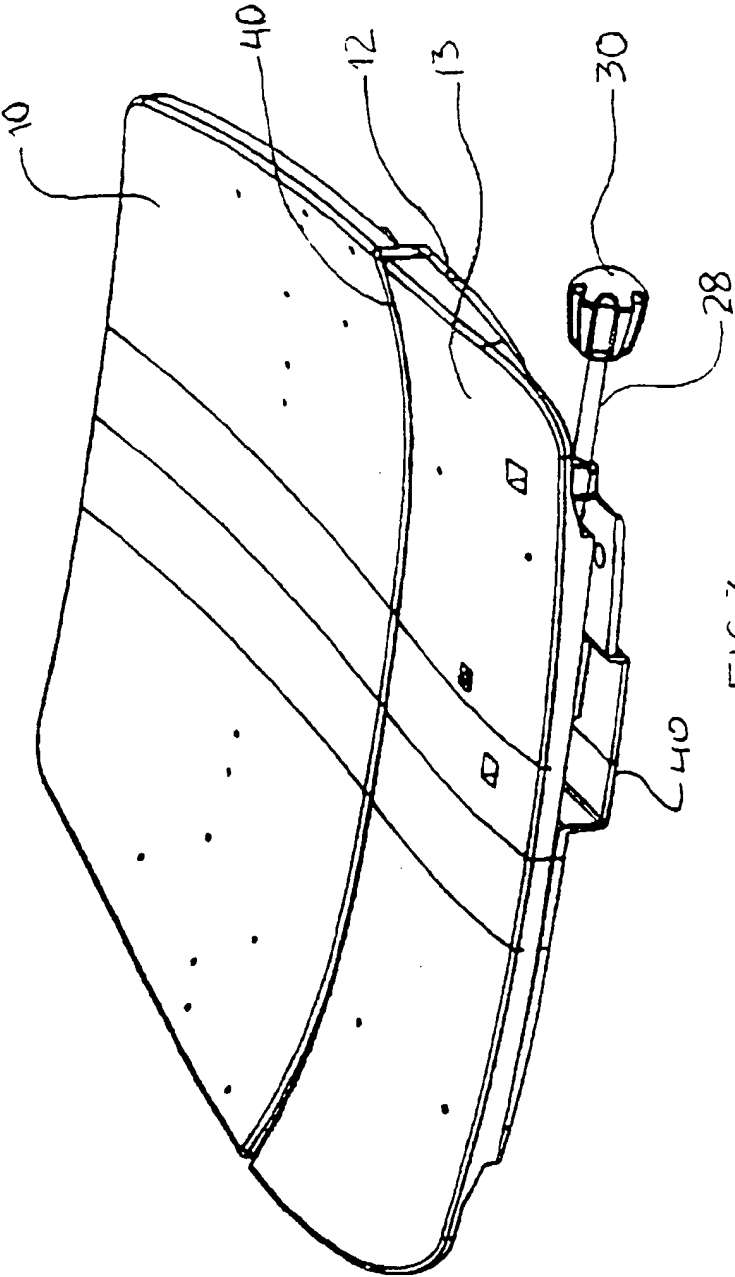


FIG. 3

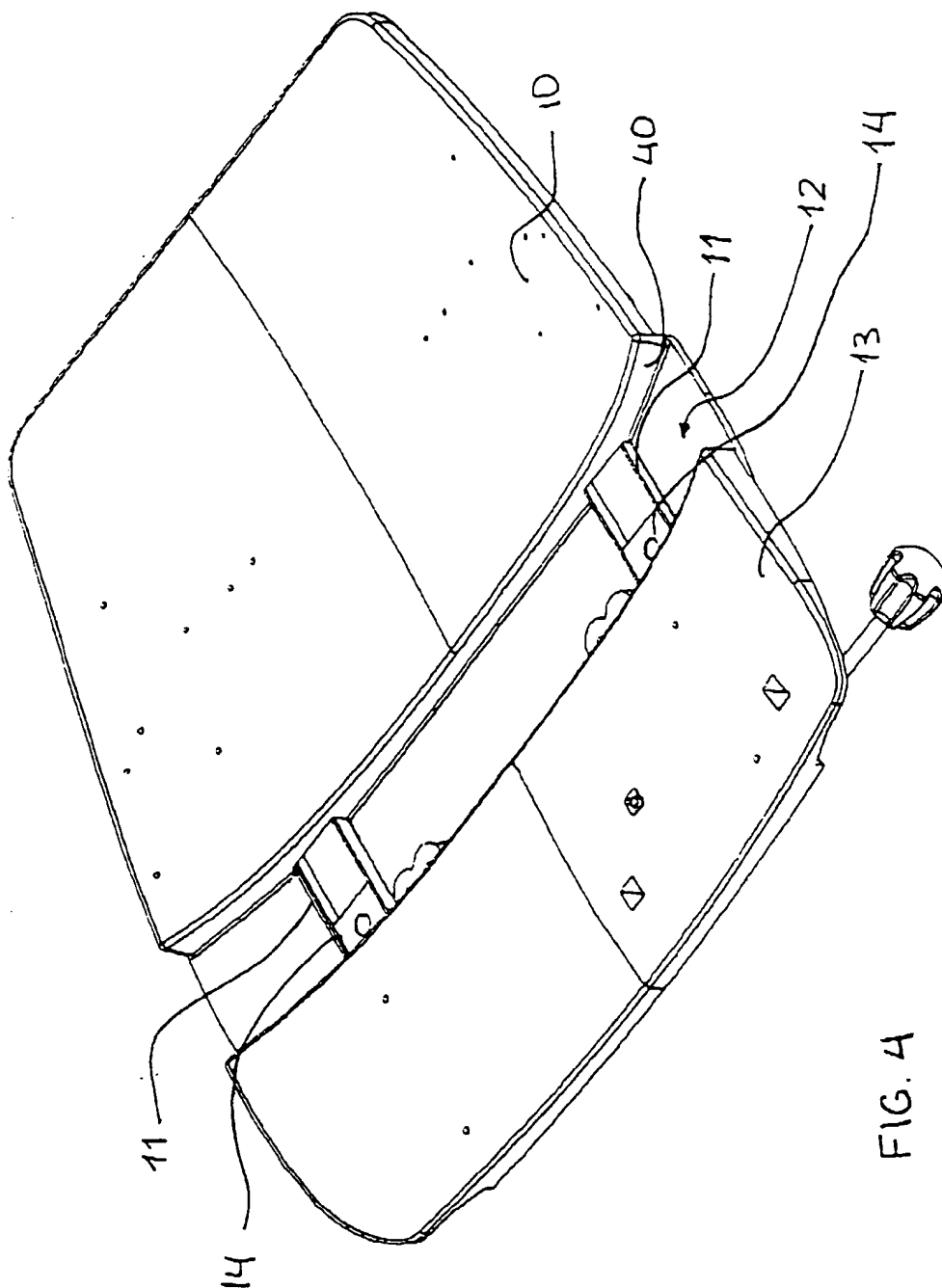


FIG. 4

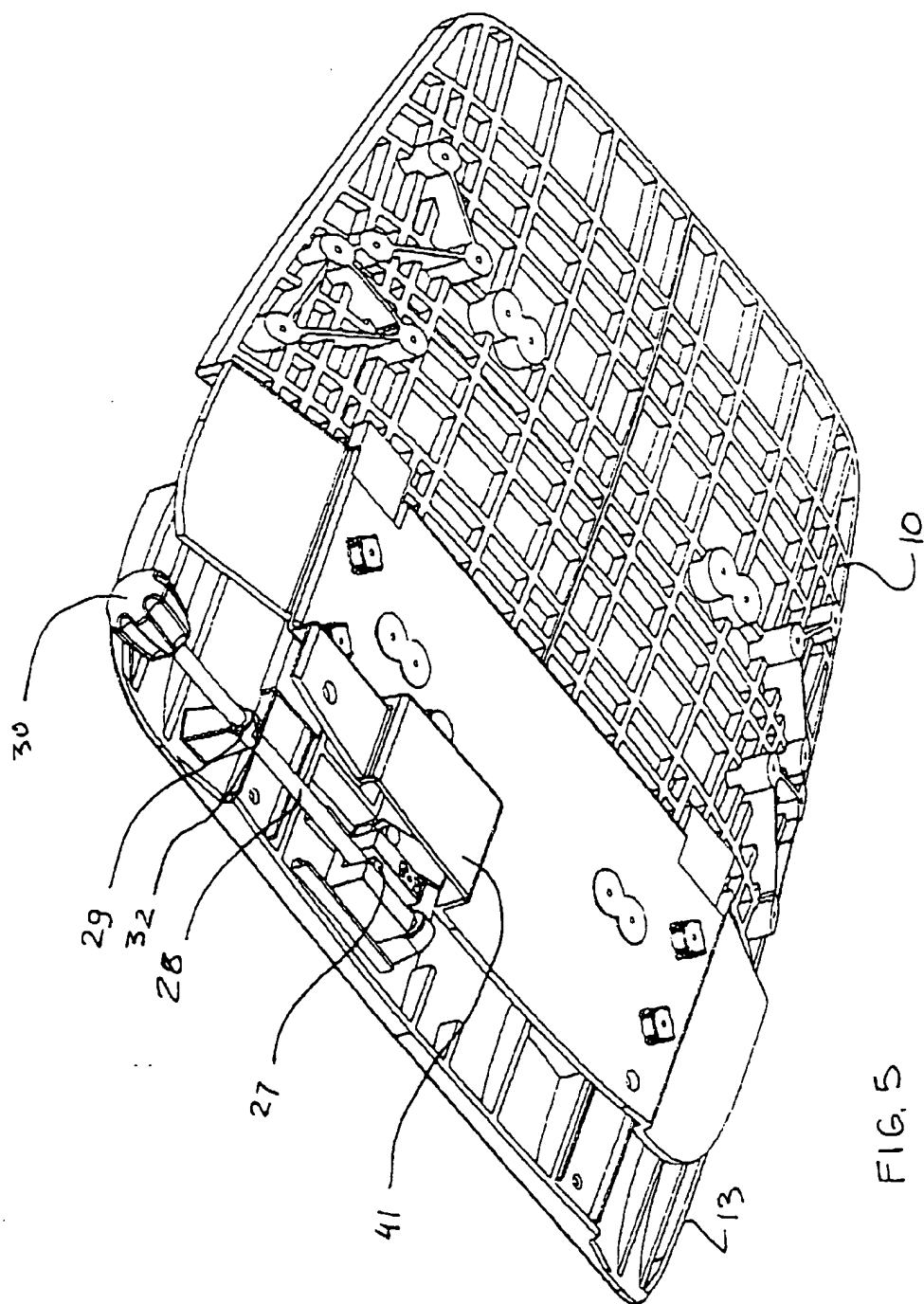


FIG. 5

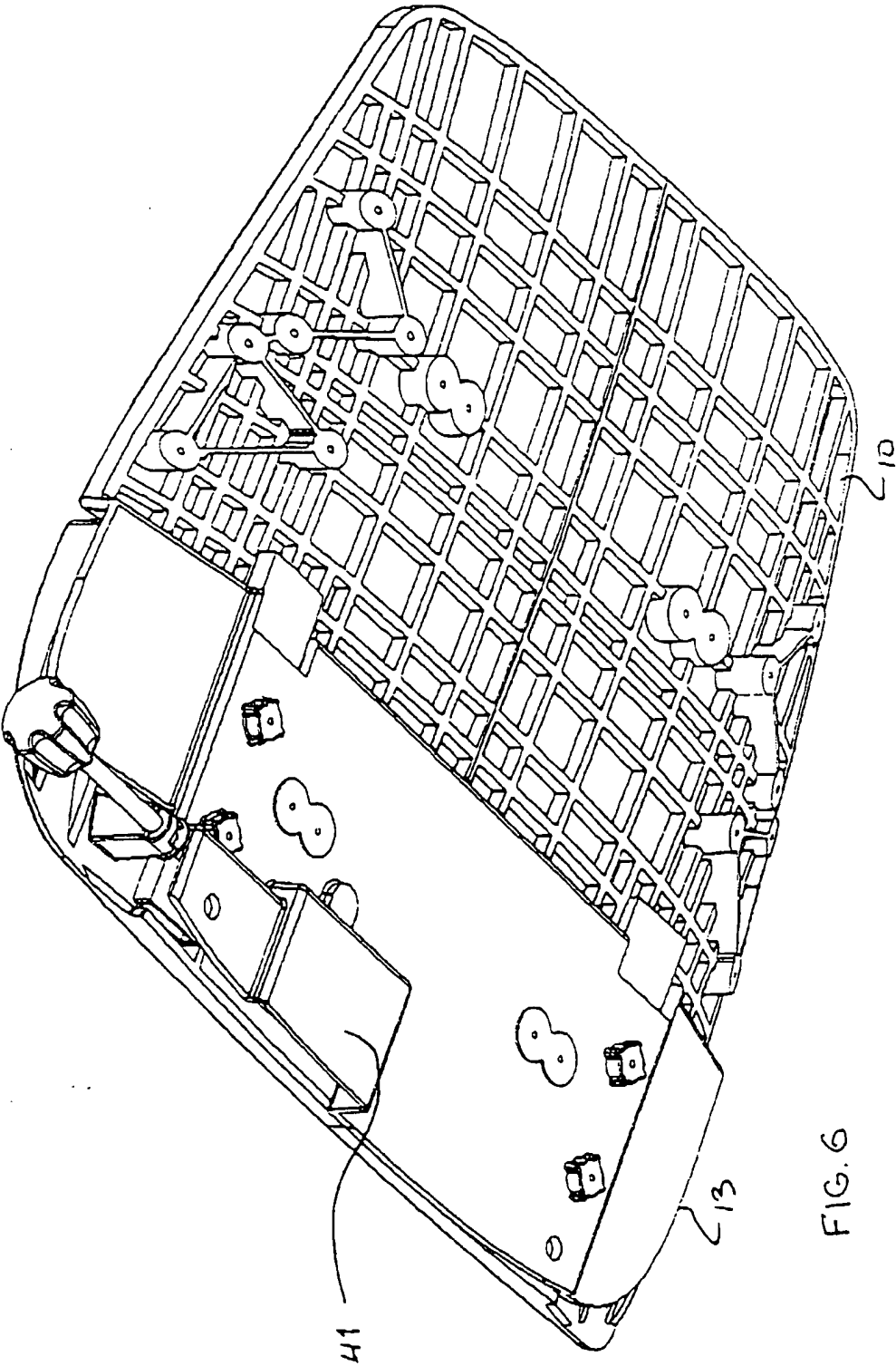


FIG. 6

